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SMALL FORM FACTOR
LOW-POWER CONSUMPTION
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EKINOPS 360

Dynamic Optical Transport
for Metro, Regional and Long Haul

40G/100G
WaveBonding[®]

Economical 40G and 100G
in the Near Term

T-Chip[®] TRANSPORT ON A CHIP
TECHNOLOGY

Lowering the Overall Cost
of Equipment

DynaFEC[®]

Cost-Effectively Achieving
Long Distances with Software

DynaMux[®]

Efficient Utilization
of Wavelengths & Fiber



EKINOPS 360

Dynamic Multi-Reach Optical Transport Platform

OVERVIEW

The Ekinops 360 Dynamic, Multi-Reach Transport system is a next generation optical transport platform that provides DWDM and CWDM in a single product and addresses metro, regional, and long haul applications.

At the heart of the Ekinops 360 lies the **T-Chip**[®] (Transport on a Chip) technology that enables fast, flexible, and cost-effective service delivery. The **T-Chip**[®] technology provides all the capabilities of transport systems on a single programmable chip. Having all capabilities on a single chip provides cost and manufacturing efficiencies which in turn provide for fast and cost-effective service delivery.

The Ekinops 360 platform handles rates from 100Mbps to 40G today and can scale to 100G. Because Ekinops produces the **T-Chip**[®] and is not dependent on component manufacturers for new transport capability on the 360 system, Ekinops can deliver functionality ahead of the market, allowing our customers to stay ahead of their competition. Finally, the Ekinops 360 platform offers a wide range of scalable options ranging from “pay-as-you-grow” amplifiers to a truly scalable ROADM and 40G solution. These scalability options allow our customers to minimize their upfront costs and truly scale the system as they benefit from it.

PRODUCT DESCRIPTION

The Ekinops 360 platform is a NEBS Level 3 certified and ETSI compliant rack mountable transport system that spans metro, regional, and long haul applications.

It supports 160 10 Gbps channels today with future channel plan options scaling to 8 Tbps. In addition, the Ekinops 360 system offers a single fiber option that supports up to 64 bi-directional 10 Gbps channels today with larger channel options planned for the future. It consists of a 7RU chassis for high-density applications and a compact 2RU chassis for low-density applications. It is modular and offers unmatched density, with support of up to 50G in a 2RU shelf and 200G in a 7RU shelf.

The platform includes optical multiplexers (Mux/Demux), reconfigurable optical add/drop multiplexers (ROADM) and optical amplifiers (OA). Mux and Demux filter modules are designed in a modular fashion to accommodate channel growth without service interruption.

The Ekinops 360 supports a wide variety of services today and the **T-Chip**[®] technology enables it to adapt to meet future service requirements quickly and cost-effectively.



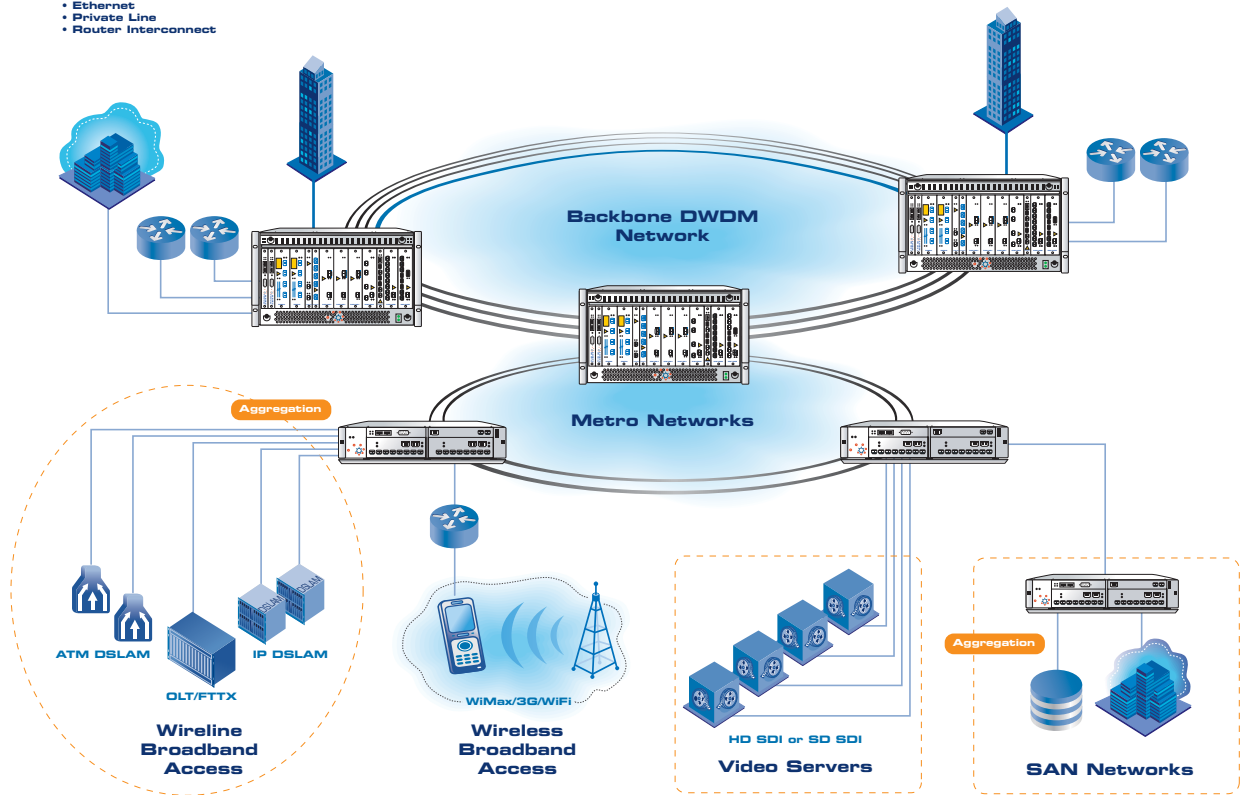
KEY FEATURES & BENEFITS

- Flexible, scalable architecture enabled by the **T-Chip**® TRANSPORT ON A CHIP TECHNOLOGY
- Highly scalable as you grow, with low upfront costs
- A single system that scales metro, regional and long haul distances over 2000km with full channel counts
- Ekinops **DynaFEC**® the industry's leading FEC technology, bringing reach through software rather than more expensive hardware solutions
- Both DWDM and CWDM on a single platform
- Scalable ROADMs support in-service upgrades from 2 degrees to 8 degrees with a low upfront cost
- Scalable amplifier technology allows amplifier cost to be incurred incrementally with service growth
- Aggregation of multiple protocols over a single wavelength (Mix Ethernet, video, Escon, SONET/SDH,...)
- Up to 300km with no in-line amplifiers, with full channel capacity
- Cost-optimized service modules for common applications
- Gateway capability for protocol bridging:
 - :: LAN PHY to WAN PHY
 - :: OC-192 to LAN PHY
- Small footprint: 2RU and 7RU, as much as half the size of competitive solutions
- Low latency
- Low-power utilization, as much as 40% less than competitive solutions
- Total transparent transport, utilizing a DCC separate from traffic but transported without a separate wavelength
- SONET/SDH PM, RMON for Ethernet
- Standard SFP and XFP support
- Line side 1+1 redundancy
- Inverse muxing at 10G for extended distances on older fiber plant
- Legacy DWDM system migration, aggregating multiple protocols into a single legacy system wavelength or service, protecting your past investment.

A SINGLE SYSTEM SPANNING METRO, REGIONAL, AND LONG HAUL

Business Services

- Ethernet
- Private Line
- Router Interconnect



AGGREGATION

Using the Ekinops *DynaMux*® Technology, enabled by the *T-Chip*®, the 360 platform is capable of aggregating multiple service types and rates over one wavelength at wire speed.

This includes aggregation of virtually any mix of 100Mb, GbE, Fibre Channel (1G/2G/4G), OC-3/12/48, STM-1/4/16 and uncompressed (HD-SDI, SD-SDI, ASI) video signals onto a 10G ITU-T G.709 or OC-192 line rate. These services and rates can also be efficiently multiplexed with 10Gbps traffic (Fibre Channel, Ethernet, SONET/SDH) into a 40G line rate today, with a 100Gbps line rate coming in the future.

The Ekinops *T-Chip*® technology allows for flexible and programmable line side protocol support with future support of line rates/formats. Aggregation reduces the number of wavelengths in the network and lowers the overall cost of DWDM and CWDM networks by 30% - 50%.

The Ekinops platform's unparalleled ability to multiplex includes aggregation of even

different protocols such as GbE, GFC, HD-SDI video signals, OC-3/12/48, STM-1/4/16 on the same wavelength. This ability is highly desirable when different services are offered to the same location.

Multiple client inputs are encapsulated together with a digital wrapper, which also contains a DCC and optional Forward Error Correction (FEC). FEC is used to correct errors in long haul transport applications.

Aggregation modules utilize pluggable SFP client interfaces, allowing initial deployment with a small number of interfaces. Then SFP's can be added to support more customers on the same wavelength without service interruption and at a minimal added cost.

Finally, the Ekinops 360 system also acts as a next generation ADM. The different service types and rates that are multiplexed onto a single wavelength can be added and dropped selectively at multiple sites on a route with the use of only a single muxponder at each site.

APPLICATIONS

The Ekinops 360 is a well-rounded optical transport platform that covers a wide range of applications, from metro rings and high-capacity long haul DWDM networks to CWDM enterprise networks and point-to-point 10G services. It is an optimal solution for:

- **Ethernet Business Services**
Ethernet ADM capability and extended reach without regeneration provide for a cost-effective solution.
- **Uncompressed Video Delivery**
HD-SDI, SD-SDI and ASI video on a single wavelength muxed with Ethernet for complementary traffic.
- **Router Interconnect**
Low-cost and scalable 10G and 40G solutions using our unique **WaveBonding®** 40G/100G technology.
- **Wireless Backhaul**
Ideal for migrating from 2G to 3G and 4G. Efficient muxing of TDM, ATM and Ethernet services over a single wavelength.
- **Triple/Quadruple Play**
Allows for muxing of TDM and Ethernet services over the same wavelength.
- **Traditional Private Line**
Deliver TDM services at the cost of Ethernet.
- **Managed services**
Low-cost, low-power, scalable solution allows you to sell a pay-as-you-grow service to your customer.
- **SAN/Storage Extension**
Support for 1, 2, 4, 8, and 10 Gbps Fibre Channel today.
- **Traffic aggregation and backhaul from DSLAMs, CMTS, FTTH nodes or SONET/SDH ADMs**
Flexible multiplexing of multiple protocols over a single wavelength.
- **Submarine Transport**
Transport of full channel counts up to 300km without in-line amplifiers makes the Ekinops 360 ideal for submarine applications.

CARRIER-GRADE RELIABILITY & AVAILABILITY

The Ekinops 360 is a carrier-grade platform that offers customers maximum reliability and availability. The chassis includes redundant power supplies and fans. Each service module is hot swappable and is independent from other modules in the chassis.

Service traffic is kept on the transponder and is not carried across a backplane, which eliminates failures or any backplane speed limitations. This also allows for infinite scalability of the system to higher rates as the industry moves to 100G and beyond.

In addition, once a system is configured it is fully operational even in the event of a management card failure.

The Ekinops platform also includes protection switching capability for delivering protected services in ring or point-to-point configurations. Protection is used for restoring and maintaining service in case of fiber cuts or other network outages.

SPECIFICATIONS

• **PHYSICAL SPECIFICATIONS**

CHASSIS	CAPACITY	HEIGHT	WIDTH	DEPTH	AC POWER	DC POWER
C200	5 modules	2RU	19"	ETSI 300mm	Internal Option	Standard
C600HC	20 modules	7RU	19"	ETSI 300mm	External Option	Standard

Operating Temperature

.....-5 to +50°C / +23 to +122°F

Storage Temperature

.....-20 to +70°C / -4 to +150°F

Power Consumption

C200 maximum fully loaded	110W
C600HC maximum fully loaded	720W

• **COMPLIANCE**

..... CE, UL, CSA

• **MANAGEMENT**

Protocol	SNMP
CLI	RS232 local or SSH remote access
Web Based Craft Interface	HTTP; 10/100 Base-T Ethernet
Management Card Interface	dual RJ45 10/100, RS232

EKinops SERVICE MODULES



PM C1008 :: Aggregates GbE, Fibre Channel, SONET/SDH over 10G

The PM C1008 is a 2-slot module capable of aggregating any mix of GbE, 1/2/4 Gbps Fibre Channel, OC-12/48, STM-4/16 onto a 10G link

There are three versions of the PM C1008:

- **PM C1008GE:** Eight GbE access ports aggregated over 10G. The PM C1008GE offers Add/Drop capability allowing for linear and ring 1+1 protected configurations.
- **PM C1008LH:** Eight GbE access ports aggregated over 10G. The PM C1008LH offers point-to-point transport for long haul applications. The C1008LH features FEC for longer reach as well as 1+1 line side protection.
- **PM C1008MP:** Eight access ports can be user programmed in the field to any protocol (GbE, 1/2/4 Gbps Fibre Channel, OC-48/STM-16, OC-12/STM-4). The PM C1008MP offers Add/Drop capability allowing for linear and ring 1+1 protected configurations.

All versions of PM C1008 use SFPs for the client interfaces and XFPs for the line interface. They can also be ordered with Ekinops' OTX line optical interface (fixed or tunable wavelength). XFPs and OTX interfaces can be gray or colored (DWDM).



PM 1004 :: Aggregates four OC-48/STM-16 over OC-192/STM-64 or OTU2

The PM 1004 is a 2 slot module that aggregates four OC-48/STM-16 into a 10G line. There are four versions of the PM 1004:

PM 1004: Four OC-48/STM-16 access ports aggregated over 10G (OTU2).

PM 1004M: Four OC-48/STM-16 access ports aggregated over 10G (OC-192/STM-64).

PM 1004C: Four OC-48/STM-16 access ports aggregated over 10G (OC-192/STM-64), Clear Channel.

PM 1004DC: Four OC-48/STM-16 access ports aggregated over 10G. The PM 1004DC offers Add/Drop capability allowing for linear and ring 1+1 protected configurations.

All versions of the PM 1004 use SFPs for the client interfaces and XFPs for the line interface. They can also be ordered with Ekinops' OTX line optical interface (fixed or tunable wavelength). XFPs and OTX interfaces can be gray or colored (DWDM).

PM 1004V :: Aggregates and transports 4 SD/HD-SDI with 1x1GbE and 1xFE over a 10G link

The PM 1004V is a 3-slot module that aggregates four SD-SDI or HD-SDI with one GbE and one FE signal over a 10Gbps wavelength.

The line side interface can be an XFP or OTX. The PM 1004V is also available with a second line interface that provides 1+1 protection.





PM C1001HC/PM 1001RR :: 10G Transponders

The PM C1001HC and PM1001RR are 10G transponders supporting any protocol from 9.95 Gbps to 10.709 Gbps.

The PM 1001RR can be used as a short haul transponder or a 3R signal regenerator. The PM C1001HC is a long haul transponder supporting the Ekinops industry-leading 10dB FEC (**DynaFEC**[®]).

The PM 1001RR supports 10G Fibre Channel, OTU2, 10G Ethernet, and OC-192/STM-64. The PM C1001HC supports 10G Ethernet and OC-192/STM-64. Both the PM C1001HC and the PM 1001RR support either XFP or OTX line interfaces (fixed or tunable wavelength).



PM 1001PC :: 10G LAN PHY to 10G WAN PHY converter

The PM 1001PC converts between 10G LAN PHY and 10G WAN PHY or vice versa.

It is a cost-effective solution for connecting 10 Gigabit LAN routers to OC-192/STM-64 SONET/SDH and DWDM equipment.



PM 404 :: Multiport transponder

The PM 404 transponder has eight SFP ports providing four bidirectional multi-rate interfaces.

The eight ports of the PM 404 are split into four pairs of client and line ports, creating four WDM transponders on a card. It supports any protocol from 100Mb to 4Gbps. The PM 404 module supports any SFP type and can reach distances of 100km and beyond with 1550nm or DWDM wavelengths.



PM 253 :: Aggregates two GbE/GFC over 2.5G or OC-48/STM-16

The PM 253 aggregates two GbE or GFC inputs over an OC-48 or STM-16 line.

It offers a 1+1 protection option and accepts standard SFP optics. The OC-48 line interface is fully compatible with SONET/SDH equipment, which makes the PM 253 an ideal solution for transporting Gigabit Ethernet over SONET or SDH networks. The PM 253 can also be used as an OC-48 or STM-16 transponder with 1+1 protection.



PM 254 :: Aggregates four GbE/GFC over one or two OC-48/STM-16

The PM 254 is designed for carrying Gigabit Ethernet or Gigabit Fibre Channel traffic over SONET/SDH or WDM networks.

It aggregates either two Gigabit client ports over one OC-48/STM-16 or four Gigabit client ports over two OC-48/STM-16s.



PM 123V :: Aggregation of 3 SD-SDI video signals onto a wave or into the GigE port of any other Ekinops Muxponder/Transponder

The PM 123V provides an economical way of transporting SD-SDI video.

This module aggregates three SD-SDI video signals over a 1.25 Gbps line rate. It can be used with WDM SFPs on the line side to transmit over fiber or it can be inserted into a GigE port of another Ekinops aggregation module, such as the PM 253 or the PM C1008.

PM 124 :: Aggregation of four OC-3/STM-1 signals or four 100Mbps signals or one OC-12/STM-4 onto a 1.25 Gbps signal



Designed for transporting lower speed protocols, this module aggregates four 100Mbps Fast Ethernet ports or four OC-3/STM-1 ports or one OC-12 over a 1.25 Gbps line rate.

It can be used with WDM SFPs on the line side to transmit over fiber or it can be inserted into a Gig port of another Ekinops aggregation module, such as the PM 253 or PM C1008.

PM MC :: Any rate transponder



The PM MC supports any media and protocol from 100Mbps to 2.7Gbps.

PM OA :: Optical Amplifier



The PM OA is an Erbium Doped Fiber Amplifier (EDFA) that allows optical signals to be transmitted over longer distances without the need for regeneration.

It can amplify multiple wavelengths up to distances of several hundred kms and is protocol and data rate independent. The PM OA family contains modules for Booster/Pre-Amp applications as well as for in-line amplification.

The Ekinops Amplifier family has a unique market capability in that it can be upgraded in service. This minimizes upfront cost. Lower power amplifiers can be installed initially and later upgraded in service to allow for support of higher channel counts.

RM ORA :: Raman Amplifier



The RM ORA, Raman Amplifier, is used to extend link distances to up to 300km without the need for in-line optical amplification.

The RM ORA can also be used to extend the total unregenerated distance of the Ekinops 360 system to over 2000km with full channel counts.

RM OM :: WDM Mux/Demux



Ekinops' passive Optical Mux/Demux units support up to 80 channels and are available in different port counts.

They can be used for CWDM & DWDM applications and are designed to allow a Mux with a low channel count to be upgraded in the field to up to 80 channels without service interruption.

PM ROADM :: Reconfigurable Optical Add/Drop Multiplexer



The Ekinops ROADMs use new cost-effective ROADM technology to reduce the cost of ROADMs in an optical network while still providing the same flexibility as more expensive solutions.

Ekinops ROADMs are part of the Ekinops 360 platform and allow users to remotely insert, terminate and redirect wavelengths across the network. Ekinops' ROADM solution comes in two flavors:

- **PM ROADM F40-H** is a scalable, reconfigurable Optical Add/Drop Multiplexer designed for 40 channels. The ROADM F40-H can be used for configurations ranging from 2 to 8 degrees and can be scaled in service without disrupting traffic.
- **PM ROADM F80-H** is a scalable, reconfigurable Optical Add/Drop Multiplexer designed for 80 channels. The ROADM F80-H can be used for configurations ranging from 2 to 8 degrees and can be scaled in service without disrupting traffic.



PM OADM :: Optical Add/Drop Multiplexer

OADM modules offer Optical Add and Drop functionality of several wavelengths while passing through all other optical signals.

Specific channels can be dropped at intermediate sites along the fiber to provide connectivity to that site without the need to demux all the other wavelengths.

PM 4001 :: 40G Transponder

The PM 4001 is a native 40G solution that provides a 40G client and 40G line interface.

This module can be used to transport 40G Ethernet. The PM 4001 uses a standard CFP client interface.



PM 4004 :: 4x10G (Ethernet, SONET/SDH, OTU2) into 40G transponder

The PM 4004 is a 4x10G Ethernet, SONET/SDH, OTU2 into 40G muxponder.

This module is used to transport multiple 10G clients over a single 40G wavelength. This module consists of a **WaveBonding**[®] multiplexer combined with four PM C1001s, which provide the 10G client inputs to the 40G line provided by the **WaveBonding**[®] multiplexer. This facilitates the ultimate flexibility in migrating to 40G. The PM C1001s can be first deployed as 10G services and then later combined with our low-cost **WaveBonding**[®] multiplexer to create a 4x10G into 40G muxponder, allowing for a smooth migration to 40G while protecting your investment in 10G.



PM OPS B :: Optical protection switch for client and line redundancy

This module provides a flexible 1+1 optical protection solution.

The module is a head-end split, tail-end select optical protection switch. The PM OPS modules can be deployed in front of transponders for card and service protection, behind the transponder but in front of the system filter for individual service line protection, and behind the system filter for composite line protection.



PM OC :: Optical Coupler for single fiber and ROADM expansion

The PM OC is an optical coupler used to multiplex wavelengths bi-directionally onto a single fiber.

The PM OC can also be installed with ROADMs to allow for future in-service upgrades of the number of degrees supported by ROADM network elements.



PM 251DLH :: Long Haul 2.5G SONET/SDH Transponder

The PM 251DLH is a long haul 2.5G transponder supporting FEC.

The PM 251DLH supports OC-48 and STM-16.

CHASSIS



The C200 is a 2RU, 19" modular chassis. It can hold five standard-size modules in addition to a pluggable management card.



The C600HC is a 7RU 19" modular chassis that can hold twenty standard-size modules in addition to the management card.

Both chassis are 483mm wide and 300mm deep and are ETSI compliant.

Modules are hot swappable. These carrier-class chassis offer dual redundant and load sharing DC power feeds and have removable fans and dust filters.

An AC power option is available as a plug-in module in the C200 or externally for the C200 and C600HC.

MANAGEMENT

At the node level, the Ekinops 360 can be managed through SNMP or the Ekinops Element Management Capabilities, which includes a CLI (Command Line Interface) and the Ekinops Java-based graphical craft interface.



The Ekinops 360 management card has two Ethernet ports and one local RS232 port and is hot swappable.

The CLI is an intuitive Command Line Interface with embedded help and automatic completion, allowing complete management of the network element (administration, alarms, configuration, monitoring, inventory). The CLI can be accessed locally through an RS232 port for initial configuration or through a management network via an SSH connection.

The craft terminal is an intuitive, easy to use graphical user interface. It is accessed through a standard web browser without the need to install a specific application.

The craft terminal can be launched from the Ekinops NMS application. Ekinops elements can be managed directly via SNMP by any standard SNMP manager.

Ekinops also offers a fully functional Element Management system (The Ekinops SNMP Element Manager) and a robust Network and Service Management system (The Multi-Protocol Service and Network Manager) with advanced provisioning and monitoring capabilities.

DATA COMMUNICATIONS CHANNEL

The Ekinops 360 includes an embedded Data Communications Channel (DCC) for remote monitoring and management.

Management information is embedded and transported in the same wavelength but outside of the client traffic, eliminating the need for allocating a special wavelength.

OTX FIXED AND TUNABLE OPTICAL LINE INTERFACES

The OTX is a special optical module designed by Ekinops to achieve exceptional span distances without in-line amplification. It is mounted on the module and is not pluggable. It has an LC connector and provides the same management information as XFPs.

OTX interfaces can reach up to 300km distances with full channel counts without the need for mid-span (in-line) amplification or regeneration through the use of booster, preamps and Raman amplifiers at either end of the span. This lowers initial and ongoing costs by eliminating the need for facilities and power to house in-line amplifiers in remote or expensive areas. This is also useful for undersea applications.

The OTX optical interface can be ordered with 1550nm, fixed ITU DWDM wavelengths and tunable optics. Ekinops' new tunable optics simplify deployments and lower requirements and cost for spare parts. Ekinops' new tunable OTX supports full C-band (80 channels) with 50GHz channel spacing.

The OTX tunable can be mounted on all Ekinops PM modules supporting a 10G interface.



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FOR METRO, REGIONAL AND LONG HAUL**

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